UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/781,867 | 02/20/2004 | Edward Colles Nevill | 550-513 | 5181 |

23117 7590 10/20/2006

NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

| EXAMINER | |
|---|---|
| MCFADDEN, MICHAEL B | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2188 | |

DATE MAILED: 10/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/781,867 | NEVILL, EDWARD COLLES | |
| | Examiner | Art Unit | |
| | Michael B. McFadden | 2188 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *27 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1)☐ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 3/31/04
4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5)☐ Notice of Informal Patent Application
6)☐ Other: _____.

## DETAILED ACTION

### *Status of Claims*

1. Claims 1-33 are pending in the Application.

### *Response to Amendment*

2. Applicant's arguments filed on 27 July 2006 have been fully considered but they are not persuasive.

### *Information Disclosure Statement*

3. As required by M.P.E.P. ' 609 (C), the applicant's submission of the Information Disclosure Statements dated 20 February 2004 and 31 March 2004 is acknowledged by the examiner and the cited references have been considered in the examination of the claims now pending. As required by M.P.E.P. ' 609 C(2), a copy of the PTOL-1449 initialed and dated by the examiner is attached to the instant office action

### *Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-6, 9, 11-16, 19, 21-26, and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Wilson ("Uniprocessor Garbage Collection Techniques").

6. **Regarding Claim 1, 11, and 21,** Wilson discloses a method of controlling execution of a processing task within a processing system, said method comprising the steps of: executing said processing task including allocating memory areas for data storage, and suspending an actual execution path of said processing task at an execution point to perform memory management said memory management comprising the steps of: identifying at least one data item roots occurring in the course of execution and accessible to said processing task at said execution point which specify reference values pointing to respective ones of said memory areas **(graph of pointer relationships)**; determining a correlation between reference values corresponding to said at least one data item roots and memory areas allocated during said execution up to said execution point **(graph of pointer relationships)** by identifying at least one data item reachable from said at least one data item roots; and performing a memory management operation on allocated memory areas in dependence upon said correlation. **(all citations from Wilson: Page 9, Section 2.2, Paragraph 1)**

7. **Regarding Claim 2, 12, and 22,** Wilson discloses wherein each of said at least one data items is an operand. **(Wilson: Page 5, Section 1.3) The paper makes the simplification that objects being collected are from the variety of types possible and that it is easy to determine the type of an object.**

8. **Regarding Claim 3, 13, and 23,** Wilson discloses wherein said identifying step comprises: identifying a possible execution path leading to said execution point, wherein said possible execution path may be different from said actual execution path; performing a simulated execution of said possible execution path; and wherein said at least one data item roots and said at least one data items accessible to said processing task are identified by following said possible execution path to said current execution point. **Traversing the graph of pointer relationships, usually by either depth-first or breadth-first traversal. (Wilson: Page 9, Section 2.2, Paragraph 1)**

9. **Regarding Claim 4, 14, and 24,** Wilson discloses wherein said memory management operation comprises marking all of said memory areas that are accessible to said processing task either directly or indirectly through said identified data items **(The objects that are reached are marked in some way; Wilson: Page 9, Section 2.2, Paragraph 1.)** and collecting unmarked memory areas for re-allocation during subsequent execution of said processing task. **(memory is swept ... find all unmarked objects and reclaim their space; Wilson: Page 9, Section 2.2, Paragraph 2)**

10. **Regarding Claim 5, 15, and 25,** Wilson discloses wherein said memory management operation comprises compacting said unmarked memory areas prior to reallocation. **(Wilson: Page 10, Section 2.3, Lines 1-7)**

11. **Claims 6, 16, and 26 are rejected using the same rationale as claim 3.**

12. **Regarding Claim 9, 19, and 29,** Wilson discloses wherein said processing task is a component of a computer program written in an object-oriented programming language. **(Wilson: Page 2, Section 1, Lines 23-28)**

## ***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 10, 20, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson ("Uniprocessor Garbage Collection Techniques").

15. **Regarding Claim 10, 20, and 30,** Wilson fails to disclose wherein said object oriented programming language is Java.

16. However, the Office takes Official Notice that it would have been obvious to a person of ordinary skill in the art to use Java as the object oriented programming language of Wilson.

17. The motivation for doing so would have been that Java allows the same program to be run on multiple operating systems, it contains built in support for networks, and it is a well understood and commonly accepted programming language among programmers.

18. Therefore, it would have been obvious to use Java as the object oriented programming language in Wilson for the benefits of allowing the program to run on multiple operating systems, containing built in support for networks, and being well understood and commonly accepted among programmers to obtain the invention as specified in claims 10, 20, and 30.

19. Claims 7, 8, 17, 18, 27, 28, and 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson () as applied to claim 6 above, and further in view of Hosoya et al. ("Garbage Collection via Dynamic Type Inference" (herein after Hosoya)).

20. **Regarding Claims 7, 17, 27, and 31-33,** Wilson discloses scanning a plurality of program instructions corresponding to said programming task and logging a data type for each store instruction corresponding to each of said at least one data items; and simulating all possible execution paths up to said execution point for each of said at least one data item root or said at least one data items. **Traversing the graph of pointer relationships, usually by either depth-first or breadth-first traversal. (Wilson: Page 9, Section 2.2, Paragraph 1)**

Wilson fails to disclose categorizing at least one of said data item roots or said at least one data items as a multiple-type variable if different data types are logged for different store instructions for a respective data item; determining the data type associated with each multiple-type variable at each of said plurality of program instructions for each of said possible execution paths; and checking said determined data type for each of said multiple-type variables at one of said plurality of program

instructions corresponding to said current execution point; and said memory management operation is performed in dependence upon a result of said step of checking said determined data type.

Hosoya discloses categorizing at least one of said one or more data items as a multiple-type variable if different data types are logged for different store instructions for a respective data item; determining the data type associated with each multiple-type variable at each of said plurality of program instructions for each of said possible execution paths; and checking said determined data type for each of said multiple-type variables at one of said plurality of program instructions corresponding to said current execution point; and said memory management operation is performed in dependence upon a result of said step of checking said determined data type. **(Hosoya: Abstract, Lines 2-6 and Page 216, Lines 3-11)**

Wilson and Hosoya are analogous art because they are from the same field of endeavor, garbage collection.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the type inference garbage collection of Hosoya into the garbage collection techniques of Wilson.

The motivation for doing so would have been that the garbage collection technique of Hosoya collects more garbage than any other algorithm using the same type system does. **(Hosoya: Page 233, Section 9, Lines 4-7)**

Therefore, it would have been obvious to combine the type inference garbage collection of Hosoya into the garbage collection techniques of Wilson for the benefit of

collecting more garbage than any other algorithm using the same type system does to obtain the invention as specified in claims 17, 18, and 19.

21. **Regarding Claims 8, 18, and 28,** Wilson fails to disclose wherein said memory management operation involves tagging said at least one data item as suitable for reallocation if said determined data type is different for different ones of said possible execution paths at said current execution point.

Hosoya discloses wherein said memory management operation involves tagging said data item as suitable for reallocation if said determined data type is different for different ones of said possible execution paths at said current execution point. **(Hosoya: Abstract, Lines 2-6 and Section 1, Lines 1-5) Where Hosoya does not specifically say that semantic garbage will be reallocated it is understood that when speaking about garbage collection, garbage will be collected and reallocated.**

## ***Response to Arguments***

22. Applicant's arguments filed 27 July 2006 have been fully considered but they are not persuasive.

23. **Regarding Claims 1, 11, and 21,** Applicant contends that Wilson does not disclose where after suspension of an actual execution path of the processing task, at least one data item root is dynamically identified, and the roots are accessible to the processing task at the execution point corresponding to the suspension of the execution path. **However, Wilson: Page 9, Section 2.2, Paragraph 1 clearly explains that**

**identifying roots and following them to determine live items. It is known to one of skill in the art that garbage collection occurs at a point in an execution path where execution is suspended in order to perform garbage collection.**

24. **Regarding Claims 7, 8, 10, 17, 18, 20, 27, 28, and 30,** Applicant contends that the rejection of the claims is traversed due to the dependence on the independent and corresponding traversal. **However, the rejection of the independent claims has been maintained above, therefore the claims remain rejected.**

25. Also, Applicant contends that there is no motivation for combining the Wilson and Hosoya references. **However, as previously stated in the rejection the motivation for doing so would have been that the garbage collection technique of Hosoya collects more garbage than any other algorithm using the same type system does.**

26. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

## ***Conclusion***

27. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael B. McFadden whose telephone number is (571)272-8013. The examiner can normally be reached on Monday-Friday 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Manorama Padmanabhan can be reached on (571)272-4210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MBM
10/11/2006

HYUNG SOUGH
SUPERVISORY PATENT EXAMINER